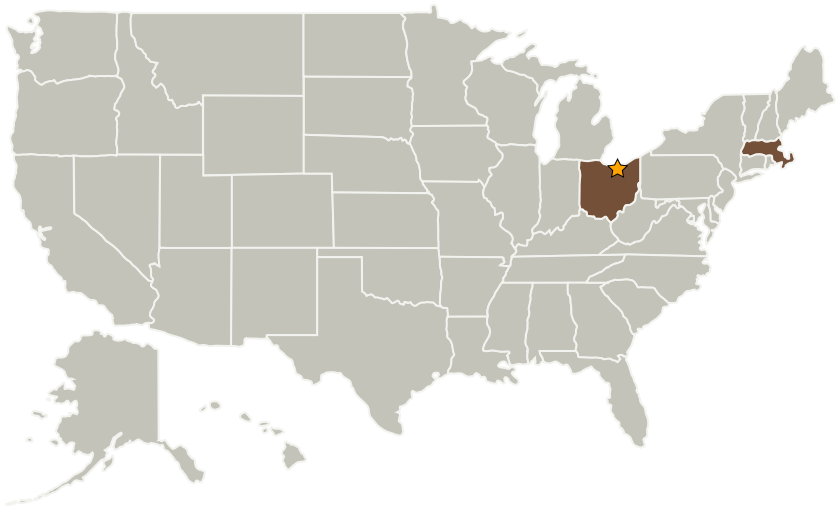
Nanostructured InGaP Solar Cells, Phase II

Completed Technology Project (2009 - 2011)

Project Introduction

Current matching constraints can severely limit the design and overall performance of conventional serially-connected multijunction solar cells. The goal of this SBIR program is to enhance the operating tolerance of high efficiency III-V solar cells by employing nanostructured materials in advanced device designs. A larger fraction of the solar spectrum can potentially be harnessed while maximizing the solar cell operating voltage by embedding thin layers of narrow band gap material in a higher band gap matrix. Nanostructured devices thus provide a means to decouple the usual dependence of short circuit current on open circuit voltage that limits conventional solar cell design. While previous experimental work on quantum well or quantum dot solar cell devices has typically employed GaAs as the wide band gap matrix, we take a different approach, instead employing InGaP as the barrier material. During the Phase I effort, we observed that thin InGaP layers can be extremely effective at reducing the dark current. A novel device structure resulted in over a 100 mV enhancement in the open circuit voltage of GaAs PIN diodes solar cells without any degradation in the short circuit current. The Phase II program will aim to further optimize single-junction nanostructured InGaP solar cells and then utilize these cells as building blocks to construct robust, multijunction photovoltaic devices with power conversion efficiencies approaching 40%. Ultimately, the technical approach employed in this program has the potential of achieving conversion efficiencies exceeding 50% with a single p-n junction device, enabling improved overall performance and lower manufacturing costs.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Kopin Corporation	Supporting Organization	Industry	Taunton, Massachusetts

Primary U.S. Work Locations	
Massachusetts	Ohio

Project Transitions

February 2009: Project Start

February 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic